

WHAT IS CLAIMED IS:

1. An apparatus for conducting a polymerization process, said apparatus comprising a reactor including:

a heated reactive section in which substantial polymerization of polymer solids

5 therein occurs;

a dispensing section for dispensing polymer solids from said reactor, said

dispensing section defining an interior volume;

a gas inlet connective with the interior volume of the dispensing section for

delivering gas to the dispensing section to heat or cool polymer solids

10 traveling through the dispensing section; and

a gas outlet connective with the reactor proximate the dispensing section for

withdrawing gas from the dispensing section.

2. The apparatus of claim 1 wherein the dispensing section includes a frusto-
conical portion with a small diameter opening out of which the polymer solids exit the
15 reactor.

3. The apparatus of claim 2 wherein the reactive section is cylindrical and
which is connective with a large diameter opening of the dispensing section.

4. The apparatus of claim 1 wherein a gas cooler is in communication with the
gas inlet.

5. The apparatus of claim 1 wherein a gas mover is in communication with the gas inlet.

6. The apparatus of claim 1 wherein a dust removing device is in communication with the gas outlet.

5 7. The apparatus of claim 1 wherein a variable capacity gas mover or a control valve regulates the flow rate of gas withdrawn from the gas outlet.

8. The apparatus of claim 4 wherein the gas cooler communicates with a purge line that delivers gas that has been withdrawn from the reactive section of the reactor to the gas inlet.

10 9. The apparatus of claim 8 wherein said purge line includes a control valve upstream of a communication with the gas cooler.

10 10. The apparatus of claim 1 wherein the gas inlet includes an annular distributor with openings in communication with, but not substantially extending into, the interior volume of the dispensing section of the reactor.

15 11. A process for cooling polymer solids in a reactor comprising a reactive section and a dispensing section comprising:

delivering polymer solids to the top of said reactive section;

polymerizing said polymer solids as they flow downwardly in the reactive

section so as to increase the molecular weight of the polymer solids;

20 dispensing said polymer solids from said dispensing section of said reactor;

delivering gas to said dispensing section to flow countercurrently to said
polymer solids and contact and heat or cool the polymer solids in said
dispensing section; and

withdrawing some of the gas at an outlet proximate to said dispensing section.

5 12. The process of claim 11 including cooling said gas withdrawn proximate to
said dispensing section.

13. The process of claim 12 wherein the rest of the gas not withdrawn from said
outlet purges impurities from the polymer solids in the reactive section and is
withdrawn from the reactive section.

10 14. The process of claim 13 wherein gas withdrawn from the reactive section is
combined with gas withdrawn proximate to said dispensing section after gas withdrawn
proximate to said dispensing section is cooled.

15 15. The process of claim 11 wherein the ratio of a mass flow rate of the gas
multiplied by the heat capacity of the gas to a mass flow rate of polymer solids
multiplied by the heat capacity of the polymer solids over a temperature range in the
reactor is at least one.

16. The process of claim 14 wherein the gas withdrawn from the reactive section
has impurities therein oxidized and is dried before it is combined with gas withdrawn
from said dispensing section.

20 17. The process of claim 12 wherein the gas withdrawn proximate to the
dispensing section is filtered before it is cooled.

18. The process of claim 12 wherein the flow rate or temperature of gas recycled to the dispensing section is regulated to achieve a desired temperature of polymer solids in the dispensing section.

19. The process of claim 11 wherein said temperature of said polymer solids
5 leaving said dispensing section is below 150°C (302°F).

20. A process for adjusting the temperature of moving solids in a vessel by direct heat exchange with a gas comprising:

delivering solids to a first section of said vessel;

dispensing said solids from a second section of said vessel; and

10 flowing gas through said vessel to effect direct heat exchange between said gas and said solids wherein a ratio of a mass flow rate of the gas multiplied by the heat capacity of the gas to a mass flow rate of solids multiplied by the heat capacity of the solids over a temperature range in the reactor is at least one.

15